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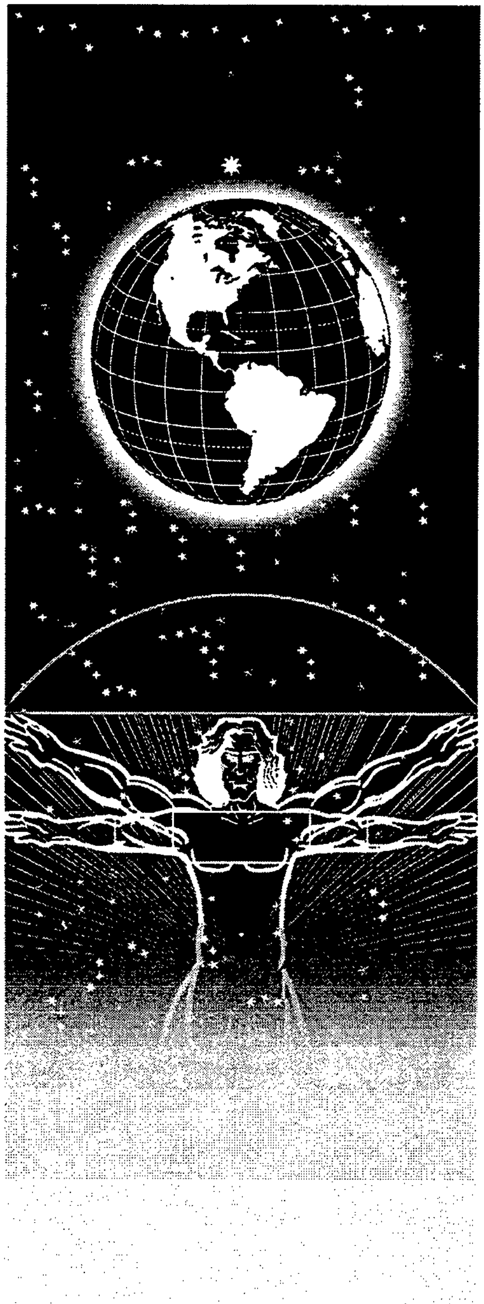

UNITED STATES AIR FORCE
IERA

Guidance for Conducting Potable Water System Sanitary Surveys and Water Vulnerability Assessments

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February 1999

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This report has been reviewed and is approved for publication.

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This report provides guidance on how to conduct water vulnerability assessments and sanitary surveys. It includes a description of each type of survey, a checklist that can be modified for use at base level, and a sample report format. This report should be used along with other applicable reference material, by someone familiar with the water system being evaluated. The report is intended as guidance and should be modified to fit the specifics of the given application.

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GUIDANCE FOR CONDUCTING POTABLE WATER SYSTEM SANITARY SURVEYS AND VULNERABILITY ASSESSMENTS

INTRODUCTION

The purpose of this document is to provide guidance for performing potable water system vulnerability assessments and sanitary surveys at military installations. Water vulnerability assessments (WVA) are a means of identifying potential threats (e.g., natural disasters, accidents, or sabotage) to the installations ability to provide adequate quantities of potable water in emergency situations. The purpose of a sanitary survey is to ensure that water free of microbiological contamination is delivered to consumers under normal operating conditions. Both water vulnerability assessments and sanitary surveys should be conducted, and the results used, to help systems improve operational practices. Each study is designed to identify shortcomings in the delivery of potable water. A water vulnerability assessment focuses on extreme events (e.g., tornadoes, earthquakes, floods, attacks, etc.) and identifies aspects of the water system that may cause system failure. A sanitary survey focuses on day to day practices and identifies circumstances where routine operations or existing conditions could cause system contamination.

Many benefits are associated with conducting sanitary surveys and water vulnerability assessments. The potential benefits include:

- operator education
- source protection
- risk evaluation
- technical assistance and training
- independent system review
- improvement of system compliance with drinking water regulations
- reduced risk of waterborne disease outbreaks
- improved disaster response readiness
- improved system security

A sanitary survey is defined in 40 Code of Federal Regulations (CFR) 142.2 as "an onsite review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water." Under 40 CFR 142.10(b)(2), each state must establish a systematic program for conducting sanitary surveys of public water systems as a requirement for primacy.

States are expected to place emphasis on conducting sanitary surveys of drinking water systems not in compliance with drinking water regulations. This means that if a

military installation has had problems in the past, regulators are more likely to conduct inspections in the future. If the installation is not being conscientious in maintaining and operating its water system, then it is opening itself up to inspections and possible fines. Even worse, an installation that does not conduct sanitary surveys regularly increases the possibility of waterborne disease outbreak. Widespread illness on a military installation, no matter what the cause, detracts from the installation's readiness and ability to perform its daily mission.

The requirement for WVAs originates from the Safe Drinking Water Act which mandates that a water supply dependably comply with maximum contaminant levels. One of the express benefits of conducting vulnerability assessments is improved disaster response preparedness. The primary goal of a water vulnerability assessment at a military installation is disaster response preparedness. However, at a military installation, it is necessary to evaluate disaster response preparedness in more detail than at the average public water system. Water is an essential component to almost every mission in the military. An installation must make every effort to ensure that an adequate quantity (volume and pressure) of quality water is available to maintain mission readiness. The security of our nation depends on it.

In addition to planning for natural disasters and accidents, a vulnerability assessment for a military installation must include an assessment of the impact of terrorism and sabotage. The report should assess the impact of conventional, chemical, biological, or nuclear attack when they are considered a threat. While terrorist bombings reveal the destruction that can be wrought with explosives, intentional contamination of an installation's water supply with a deadly agent could produce mass casualties before the facility realizes it has been the target of a terrorist attack. A thorough water vulnerability assessment can help an installation minimize mission impacts by identifying weaknesses in water treatment, storage, and distribution systems, and by allowing the base to plan for system disruptions that cannot be prevented.

Air Force Instruction (AFI) 48-119, paragraph 9.6.3.4, requires that base Bioenvironmental Engineering Services (BES) conduct sanitary surveys and vulnerability assessments of potable water supplies as well as conduct engineering reviews of proposed modifications to the water system to assess and avert health hazards. AFI 41-106, paragraph 1.5.16, requires the Medical Treatment Facility Commander or Medical Group Commander to conduct food and water vulnerability studies at deployment sites and fixed installations overseas. These water vulnerability assessments should be conducted by BES in conjunction with Civil Engineering personnel. Air Force Occupational Safety and Health (AFOSH) Standard 48-6 (draft) requires Bioenvironmental Engineering to complete water vulnerability assessments, in conjunction with Civil Engineering, of all non-recreational water systems. Medical personnel at deployed and forward operating locations must also conduct WVAs. Medical Treatment Facility Commanders are required to assure water vulnerability studies are conducted for deployment sites and fixed installations. The Bioenvironmental Engineering Flight (BEF) is further responsible for advising the commander with respect to wellhead protection programs,

opportunities to enhance water treatment and distribution systems, and alternative management practices to meet compliance requirements and enhance water quality. BEF conducts these activities in coordination or conjunction with other hospital or base organizations including Civil Engineering, Environmental Management, and Office of Special Investigations. There are many references that base personnel can use in conducting sanitary surveys and water vulnerability assessments. Following is a list of references that may be useful:

1. Emergency Planning for Water Utility Management, American Water Works Association Manual 19.

2. Potable Water Emergency/Contingency Plan, Water Supply Information paper NO. IP 31-020, prepared by United States Army Center for Health Promotion and Preventive Medicine (CHPPM), 27 February 1998.

3. Biological Warfare Agents as Potable Water Threats, Medical Issues Information Paper NO. IP-31-017, prepared by United States Army Center for Health Promotion and Preventive Medicine (CHPPM), March 1998.

4. Water Vulnerability Assessments, prepared by Armstrong Laboratories Occupational and Environmental Health Directorate, AL-TR-1991-0049.

5. Standard checklists from individual states for conducting water system sanitary surveys.

DISCUSSION

The Sanitary Survey Process

The process of conducting a sanitary survey can vary by location, depending on system specific variables, but certain basic components must be evaluated in all situations. Three phases are necessary in completing a sanitary survey. The first phase involves planning the survey. The second phase is the actual physical inspection of relevant facilities. The final phase of the survey is a written report identifying the status of the system and any remarkable findings. The report should be in enough detail that someone familiar with water systems in general, but unfamiliar with base specific circumstances, would understand the survey results. Eight essential elements of a drinking water system sanitary survey include:

- Element 1 - Source water evaluation
- Element 2 - Water treatment evaluation
- Element 3 - Distribution system evaluation
- Element 4 - Finished water storage evaluation
- Element 5 - Pump and pump facility evaluation

- Element 6 - Monitoring, reporting, and data evaluation
- Element 7 - Operations and management evaluation
- Element 8 - Operator compliance with state requirements

40 CFR 141.21(d) requires sanitary surveys be performed at least once every five years for Public Water Systems that do not collect five or more routine (total coliform) samples/month. Specific state standards may be stricter than the federal standards and may require sanitary surveys without regard for the number of samples collected. Some states require certification of surveyors. At many installations, sanitary surveys are performed by the state regulatory agency. If a state agency does not conduct a sanitary survey, then environmental personnel should conduct an internal survey periodically. Even at installations where a regulatory agency conducts an inspection or regulations do not require a survey, it is a good idea for environmental personnel to conduct an internal survey. An internal survey allows the base to identify and correct any problems before a state regulator discovers them or a maximum contaminant level (MCL) is exceeded, and it ensures that installation personnel are involved in and aware of all aspects of the potable water system.

Prior to conducting a successful sanitary survey, some degree of planning is necessary. The required pre-survey planning will vary with the knowledge and experience of the individuals conducting the survey. In all cases, the surveyor should make a list of components to be evaluated during the survey. Everything that impacts the potable water system should be examined. Generally, a list of questions should be developed before the physical inspection begins. Appendix A contains a sample list of survey questions that can be used by an installation conducting a sanitary survey. The installation should carefully review this questionnaire and tailor it to fit specific needs.

Once a plan of attack and survey questionnaire are finalized, the physical inspection of facilities can begin. A single person should head the survey team and should be present at all facility inspections to ensure consistency in the inspection process. Generally, the person with the most experience operating and maintaining the water system should be charged with conducting the sanitary survey. The responsible person can augment his or her inspection team with any resources they feel are required. Generally, the physical inspection portion of the sanitary survey should be completed in one week. For large systems additional time may be required, while for small systems a couple of days may be adequate.

Once the physical inspection is complete, a report must be generated for continuity and documentation of relevant findings. The level of detail in the report will vary depending on the intended audience. If a commander is going to review the report, then the performing agency may want to invest some time highlighting important findings. A briefing on the report findings may be appropriate in such circumstances to make commanders aware of any important findings and to keep them abreast of activities performed by the organization. If the report is to be used solely for internal purposes,

then less background information may be appropriate. The report should be easily readable and clearly present findings. Installations should check with state regulators to see if the state has a required format for sanitary survey reports.

Once the survey is complete and the report is finalized, any problems identified during the course of the survey should be addressed as appropriate. Any problems with the system that represent a threat to human health or the environment should be corrected immediately. Less severe problems should be addressed as manpower and funding are available. Installation personnel should prioritize the necessary system improvements and act on them appropriately.

The Water Vulnerability Assessment Process

All of the information gathered during a sanitary survey is useful in a water vulnerability assessment. The difference between the sanitary survey and the vulnerability assessment is in the application of the collected data. The American Water Works Association (AWWA) describes the basic process for conducting Water Vulnerability Assessments in AWWA Manual 19. This six-step process has been adopted in AFOSH Standard 48-6 (draft) and is briefly summarized below.

Step 1: Identify and describe the water system by subsystem/component

The first step is to identify the major components that make up the supply, treatment, and distribution subsystems. These components are characterized in terms of external factors that determine whether or not the component will operate properly.

Step 2: Identify probable hazards and hazard magnitude

The second step involves identifying and characterizing both peacetime and war-related hazards that may affect the installation. The specific threats considered will vary depending on what threats exist at the installation being evaluated. Both the probability of a hazard event and its likely magnitude should be considered. The resulting set of "design" events will be used to determine impacts on water system components identified in Step 1.

Step 3: Estimate the likely effect on system components

In this step, the impact of each design event is considered relative to the attributes and external factors controlling the proper operation of water system components. This is comparable to a failure modes and effects analysis where the potential for component failure is assessed relative to event magnitude and the probable consequences of this failure on water quality and availability are determined.

In assessing probable effects, consideration must be given to compliance with the Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs). Hazard events

can cause changes to source water quality and the introduction of contaminants into the distribution system (e.g., pipeline breaks or unit malfunction) which could cause the facility to exceed the MCLs.

Step 4: Estimate the water demand (quantity/quality) following the event

In estimating water demand, consider both water quantity and quality. Water demand is the sum of the requirements for personal use, firefighting, water system delivery loss, and critical industrial and operational requirements. Broken mains and transmission lines create additional demand.

Step 5: Estimate the supply shortfall by comparing supply and demand

Overall system vulnerability to a hazard event may be measured in terms of the difference between the available water supply both during and after an event relative to the demand during these same periods. A hazard event may affect water quantity and/or quality. Vulnerability should be measured in terms of the magnitude and duration of any supply shortfall or quality reduction. It is difficult to determine specific supply shortfalls because most bases do not meter water users. Personnel should keep the big picture in mind when data is not available and prioritize critical water needs.

Step 6: Identify components responsible for the shortfall or quality reduction and possible mitigating measures

In this final step, component failures are assessed and ranked relative to their contribution to supply shortfall or quality reduction for each event. Those components that contribute the most to a shortfall should be designated as "critical." Mitigating measures are then identified for each component failure or quality degradation with particular attention given to critical component failures.

Note that this process requires cooperative input and joint analysis by the BES, Civil Engineering, and other affected organizations. It considers water supply and demand analyses, water quality issues, and available/deliverable quantity. With respect to water quality, the Air Force must comply with regulations promulgated under the SDWA, as well as additional regulations developed by the States, and make emergency plans for use of lower quality water. Overseas bases must also consider host nation rules, the Overseas Environmental Baseline Guidance Document (OEBGD), and Final Governing Standards (FGS). If the installation has a calibrated hydraulic model of the drinking water system, the model can be used to estimate available water supply during different scenarios.

CONCLUSION

A team approach is essential to completing a useful water vulnerability assessment and/or sanitary survey. Essential members of a survey team include

representatives from the Bioenvironmental Engineering Flight, Civil Engineering, the Office of Special Investigations, Security Forces, the Fire Department, major water users, and anyone involved in operating or maintaining the water system.

Special consideration should be given to classification of these survey reports. Air Force Regulation 205-6 requires that anything that discusses a vulnerability on an air base must be classified at least secret. Security classification of the survey report should be made locally. These issues can be discussed and worked out with other members of the team as described above. One approach is to separate the sanitary survey and vulnerability assessment reports. The sanitary survey, which highlights general information about the system, may not require classification. A separate report covering the vulnerability assessment would be classified. These issues must be worked out at the installation level with the appropriate security personnel.

REFERENCES

1. Burrows, W. Dickinson and Sara E. Renner. Biological Agents as Potable Water Threats. U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM), Medical Issues Information Paper NO. IP-31-017, March 1998.

2. Emergency Planning for Water Utility Management. American Water Works Association Manual for Water Supply Practices, AWWA M19, 1994.

3. Garland, John G. III. Water Vulnerability Assessments. Armstrong Laboratory Occupational and Environmental Health Directorate, AL-TR-1991-0049, April 1991.

4. Potable Water Emergency/Contingency Plan. Prepared by U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM), Water Supply Information Paper NO. IP-31-020, February 1998.

APPENDIX A

SITE INFORMATION

SITE OR FACILITY NAME:

LOCATION:

PUBLIC WATER SYSTEM NUMBER:

NAMES OF RESPONSIBLE PERSONS:
Bioenvironmental Engineering Services:

CE Utilities:

CE Readiness:

Office of Special Investigations:

Safety:

Fire Department:

Other:

SITE DESCRIPTION:

MISSION DESCRIPTION:

WATER SYSTEM DESCRIPTION: (INCLUDE FLOW DIAGRAM IF POSSIBLE)

AVERAGE DAILY PRODUCTION (MGD) SUMMER:
WINTER:
PEAK:

NUMBER OF PEOPLE SERVED:

SYSTEM AGE OR DATE MAJORITY OF CONSTRUCTION OCCURRED:

☐ Y ☐ N UPDATED COMPUTER MAP AVAILABLE

NOTES:

HAZARD ANALYSIS

HAZARD TYPE	PROBABILITY	COMMENTS
FLOOD		
ELECTRICAL STORMS		
HURRICANE/TROPICAL STORMS/HIGH WINDS		
TSUNAMI		
EARTHQUAKES		
BRUSH FIRES		
LAND SLIDES		
EXTREME COLD		
VOLCANOS		
AIRCRAFT MISHAPS		
SABOTAGE/VANDALISM/ TERRORISM		
WARTIME ATTACK – PHYSICAL DAMAGE (CONVENTIONAL/NUCLEAR)		
WARTIME ATTACK – SYSTEM COMTAMINATION (NBC)		

NOTE: Only address hazards considered a threat to the installation.

OSI NOTES:

SECURITY FORCES NOTES:

CE READINESS NOTES:

WATER SYSTEM COMPONENTS (PUMPS, WELLS, STORAGE, ETC.)

Indicate all main components of the water system, to include wells, pumps, storage units, treatment houses, etc. Under comments, indicate purpose of device, size, material, rate, capacity, etc.

FACILITY NUMBER	COMPONENT TYPE (WELL, STORAGE...)	COMMENTS

SOURCE AND TRANSMISSION

☐ OWN/OPERATE ☐ PURCHASE
☐ GROUNDWATER ☐ Y ☐ N ☐ U/K UNDER SURFACE WATER INFLUENCE? ☐ TESTED?
☐ SURFACE WATER
COMMENTS: WELL, PUMP OR WITHDRAWAL POINT(S):
☐ ON-SITE ☐ OFF-SITE
☐ Y ☐ N SECURITY SYSTEMS
☐ Y ☐ N FENCED ☐ Y ☐ N BARBED WIRE
☐ Y ☐ N LOCKED
☐ Y ☐ N LIGHTED
☐ Y ☐ N OWNERSHIP AND KEEP OUT SIGNS POSTED
☐ Y ☐ N REMOTELY OPERATED
☐ Y ☐ N ROUTINELY MONITORED? FREQUENCY:
☐ Y ☐ N CONNECTED TO BACKUP (B/U) POWER
B/U POWER OP-CHECK FREQUENCY:
B/U POWER FUEL STORAGE OR OPERATING DURATION:

WELL/FACILITY NUMBER	DEPTH (FT)	CAPACITY (GPM)

☐ Y ☐ N WELLS, PUMPS, & MOTORS IN ENCLOSED BUILDINGS
☐ Y ☐ N WELLS, PUMPS, & MOTORS OPEN TO ENVIRONMENT
☐ Y ☐ N BACKFLOW PREVENTION FOR SOURCE?
☐ Y ☐ N ☐ N/A VENTS CLEAR AND SCREENED WITH ¼" OR FINER MESH
☐ Y ☐ N BOTTLED WATER SOURCE AVAILABLE
☐ Y ☐ N EMERGENCY CONTRACT TO OBTAIN BOTTLED WATER
☐ Y ☐ N ALTERNATIVE SOURCES IDENTIFIED? LIST:
COMMENTS:
ON-HAND REPLACEMENT EQUIPMENT: ☐ PUMPS ☐ MOTORS ☐ SWITCHES OTHER:

RESPONSIBLE PARTY FOR EMERGENCY REPAIR:
APPROXIMATE RESPONSE TIME: DUTY HOURS:
NON-DUTY HOURS:

☐ Y ☐ N WELL-HEAD OR WATERSHED PROTECTION PROGRAM? DESCRIPTION:

POTENTIAL SOURCES OF CONTAMINATION (UPSTREAM OR IN WATERSHED)

☐ Y ☐ N INDUSTRIAL OPERATIONS
☐ Y ☐ N FARMING / RANCHING ☐ Y ☐ N WITHIN 50 FEET OF WELL HEAD
☐ Y ☐ N WASTEWATER TREATMENT PLANT DISCHARGE?
☐ Y ☐ N LANDFILLS
☐ Y ☐ N IRP SITES ☐ Y ☐ N ☐ U/K PLUME MIGRATION TOWARD WATER INTAKE?
☐ Y ☐ N HAZWASTE OR HAZMAT OPERATIONS
☐ Y ☐ N INTAKES SUBJECT TO FLOODING
OTHER:

SURVEY COMMENTS:

DRINKING WATER SOURCE SAMPLING INFORMATION:

☐ HISTORICAL NOTICES OF VIOLATION (NOVs) OR PROBLEMS WITH SOURCE WATER QUALITY?

DATE(S)	CONTAMINANT	LEVEL	SOURCE IDENTIFIED?

SAMPLING FREQUENCY:

NOTES:

TREATMENT

☐ CHLORINATION ☐ GAS ☐ SLURRY LEVEL:
☐ CHLORAMINATION
☐ CHLORINE DIOXIDE
☐ ULTRA VIOLET RADIATION
☐ OZONE

☐ FLUORIDATION CHEMICAL: LEVEL:
☐ COAGULATION/FLOCCULATION CHEMICAL:
☐ SEDIMENTATION
☐ FILTRATION TYPE: BACKWASH FREQUENCY:
☐ ACTIVATED CARBON ☐ POWDER ☐ GRANULAR
☐ AIR STRIPPING FOR WHAT CHEMICAL(S):
☐ pH ADJUSTMENT CHEMICAL:
☐ CORROSION INHIBITORS CHEMICAL:
☐ OTHER:

FOR GAS CHLORINATION:
☐ Y ☐ N EXTRA TANKS DURATION OF SUPPLY:
☐ Y ☐ N TANKS CHAINED/SECURED
☐ Y ☐ N PROPER VENTILAION (VENTS AT BOTTOM OF DOOR)
☐ Y ☐ N POWER FAN?
☐ Y ☐ N BOTTLE OF AMMONIA
☐ Y ☐ N BACK UP POWER & LIGHTING AVAILABLE
☐ Y ☐ N SCBA AVAILABLE FREQUENCY OF TESTING SCBA TANK:
☐ Y ☐ N WINDOW ON DOOR
☐ Y ☐ N ROOM LOCKED
☐ Y ☐ N AUTOMATIC MONITORING OR INJECTION LEVEL READOUT
☐ Y ☐ N ADEQUATE SUPPLY OF CHEMICALS (ENOUGH TO LAST UNTIL ACQUISITION AVAILABLE)
☐ Y ☐ N BACK UP POWER AVAIL TO TREATMENT EQUIPMENT ☐ DEDICATED ☐ MOBILE
OPERATION CHECK FREQUENCY FOR B/U POWER GENERATOR:
☐ Y ☐ N TEST KITS AVAILABLE FOR CHEMICALS (E.G., DPD TEST KIT FOR CHLORINE)
TESTING FREQUENCY:
☐ Y ☐ N SHELF LIFE OR QUALITY CONTROL CHECKS ON TEST KITS
☐ Y ☐ N TREATMENT SYSTEM DIAGRAM AVAILABLE OR POSTED
☐ Y ☐ N DANGER/KEEP OUT SIGNS POSTED
☐ Y ☐ N REPAIR SUPPLIES AVAILABLE
☐ Y ☐ N GAGES
☐ Y ☐ N FILTER MEDIA
☐ Y ☐ N PUMPS/METERS
☐ Y ☐ N HISTORICAL TREATMENT PROBLEMS COMMENTS:

☐ Y ☐ N ROWPU AVAILABLE NUMBER:
OPERATIONS CHECK FREQUENCY:
☐ Y ☐ N ROWPU WATER SOURCE IDENTIFIED COMMENTS:
☐ Y ☐ N TRAINED OPERATORS NUMBER:

COMMENTS:

STORAGE

TANK OR BLDG #	SIZE (1000 GALs)	TYPE (ABOVE GROUND, ELEVATED, UNDER GROUND)	MATERIAL

☐ Y ☐ N STORAGE WATER SAMPLING: FREQUENCY: TESTS:

CONTINGENCY STORAGE (WATER BUFFALOES OR BLADDERS?):

☐ Y ☐ N WATER BUFFALO CLEANING CHECKLIST
☐ Y ☐ N BACTERIA TESTING ON WATER BUFFALOES

HISTORICAL PROBLEMS/COMMENTS:

	Tank or Building Number												
On-site													
Fenced													
Locked													
Video surveillance													
Alarms													
Patrolled; Frequency													
Keep-out signs													
Telemetry													
B/U Power to pumps													
Lightning Protection													
Cathodic Protection													
Overhanging Vegetation													
Trees too Close													
Hatches Closed													
Hatches Locked													
Hatches Tight-Fitting													
Tank Surface Clean													
Tank rusting or Coating Spalling													
Vents Screened w/ ¼" or finer mesh													
Light Penetration													
Earthquake Designed													
Water level gauge operating													
Typical Water Fluctuation Range													
Year Last Inspected													
Year Last Cleaned													
Clear Piping Diagram Avail													
Switches Operating													
B/U Switches Available													
Overflow Pipe Clean, Free of Obstructions													
Overflow Pipe Screened													

STORAGE TANK INSPECTION

Tank/ Bldg Number	Structural Condition	Interior Condition	Comments: Indicate any conditions which make the unit vulnerable to contamination, sabotage, structural failure, or any other notable information that might help assess the system.

Comments:

DISTRIBUTION SYSTEM

☐ Y ☐ N CROSS-CONNECTION CONTROL PROGRAM; DATE OF LAST SURVEY:

☐ Y ☐ N DEAD-END FLUSHING; FREQUENCY:
☐ Y ☐ N FLUSHING TO CLEAR MAINS; VELOCITY: DURATION:
NUMBER OF DEAD ENDS:

☐ Y ☐ N VALVE EXERCISING; ☐ MAIN ☐ ALL FREQUENCY:
☐ Y ☐ N KEYS AVAIL
☐ Y ☐ N CURRENT MAP; COMMENTS:

☐ Y ☐ N BACKFLOW PREVENTION DEVICE (BPD) TESTING; FREQUENCY: AS REQUIRED
☐ Y ☐ N INVENTORY
☐ Y ☐ N B/U PARTS

☐ Y ☐ N HYDRANT FLOW TESTING; PROBLEMS/COMMENTS:

☐ Y ☐ N REGULAR CHLORINE TESTING
☐ Y ☐ N PRESSURE TESTING
COMMENTS/PROBLEMS:

BREAK RESPONSE:

☐ Y ☐ N SUPERCHLORINATE: ☐ SLUG ☐ HOLD COMMENTS:
☐ Y ☐ N BIOENVIRONMENTAL ENGINEERING NOTIFICATION
☐ Y ☐ N BACTERIA TEST; COMMENTS:
☐ Y ☐ N PROPER EQUIPMENT & OPERATORS AVAIL (BACK HOE, ETC.); COMMENTS:
☐ Y ☐ N REPLACEMENT/REPAIR PARTS AVAIL
☐ Y ☐ N 24 HOUR RESPONSE? ☐ IN-HOUSE ☐ CONTRACT
COMMENTS:
☐ Y ☐ N BACK UP POWER AVAIL TO BOOSTER PUMPS/MOTORS
☐ Y ☐ N REPLACEMENT PARTS AVAIL FOR BOOSTER PUMPS/MOTORS

☐ Y ☐ N CURRENT MAP OF SYSTEM LAST UPDATED:
☐ Y ☐ N AUTOMATICALLY UPDATE MAPS WITH NEW CONSTRUCTION; COMMENTS:
☐ Y ☐ N NBC TEST KITS AVAILABLE; NUMBER: ; TEST FREQUENCY:
☐ Y ☐ N TRAINED PERSONNEL FOR NBC KITS; NUMBER:
☐ Y ☐ N PRIORITY SERVICE AGREEMENTS FOR PURCHASED WATER
☐ Y ☐ N MISSION CRITICAL INDUSTRIAL WATER NEEDS

Mission Description	Flow Rate Needed (gpm)	Comments

ROUTINE BACTERIA TESTING:
☐ IN-HOUSE ☐ CONTRACT; ☐ P/A ☐ MF ☐ OTHER:
☐ Y ☐ N CHLORINE TESTING WITH BACTERIA SAMPLE; TYPICAL LEVELS:
☐ Y ☐ N pH TESTING WITH BACTERIA SAMPLE; TYPICAL LEVELS:

☐ Y ☐ N DISTRIBUTION WATER SAMPLING:

TEST	FREQUENCY	LOCATIONS / COMMENTS

HISTORICAL PROBLEMS/COMMENTS:

COMMENTS:

FIREFIGHTING

☐ Y ☐ N DEDICATED FIRE STORAGE
LIST:

BLDG OR TANK #	SIZE (1000 GAL)	TYPE (ABOVE GROUND, BELOW GROUND, ELEVATED, BUILDING TOP)	MATERIAL

COMMENTS:

☐ Y ☐ N BACKFLOW PREVENTION DEVICES ON FIRE STORAGE

☐ Y ☐ N SEPARATE FIRE DISTRIBUTION SYSTEM

☐ Y ☐ N AFFF SYSTEMS LIST BUILDINGS:

☐ Y ☐ N HYDRANT FLOW TESTING
☐ Y ☐ N ANY PRESSURE OR FLOW PROBLEMS
COMMENTS:

☐ Y ☐ N 24 HOUR FIRE RESPONSE; RESPONSE TIME:

☐ Y ☐ N FIRE DEMAND ESTIMATES AVAILABLE (FLOW, DURATION)
ESTIMATED DEMANDS:

☐ Y ☐ N PRIORITIZED FACILITY LISTING

FIRE FIGHTING CAPACITY AVAILABLE: (TRUCKS, ETC.):
COMMENTS:

☐ Y ☐ N ALTERNATIVE WATER SOURCES AVAILABLE

☐ Y ☐ N POOL; CAPACITY:
☐ Y ☐ N GOLF COURSE PONDS; CAPACITY:
☐ Y ☐ N WWTP EFFLUENT; CAPACITY:
☐ Y ☐ N SURFACE WATERS; CAPACITY:
☐ Y ☐ N CAPACITY:

COMMENTS:

☐ Y ☐ N FIREFIGHTING SUPPLY MEETS DEMAND

POWER SYSTEMS

☐ Y ☐ N BACKUP POWER AVAILABLE TO OTHER WATER SYSTEM COMPONENTS
☐ DEDICATED ☐ MOBILE
☐ AUTOMATIC ☐ MANUAL
COMMENTS:

FREQUENCY OF GENERATOR TESTING:

FUEL STORES FOR GENERATORS (VOLUME OR DURATION):

BREAKDOWN RESPONSE:
☐ IN-HOUSE REPAIR ☐ CONTRACTOR
☐ Y ☐ N REPAIR EQUIPMENT AVAILABLE
☐ Y ☐ N OPERATORS AVAILABLE
☐ Y ☐ N 24 HOUR RESPONSE; RESPONSE TIME:
☐ Y ☐ N REPAIR PARTS AND SUPPLIES AVAILABLE
COMMENTS:

POWER COMPONENTS (E.G., TRANSFORMERS)
☐ Y ☐ N SECURITY SYSTEMS
☐ Y ☐ N FENCED ☐ Y ☐ N BARBED-WIRE
☐ Y ☐ N LOCKED
☐ Y ☐ N LIGHTED
☐ Y ☐ N PATROLLED; FREQUENCY:
OTHER:

☐ Y ☐ N REDUNDANCY (POWER CONNECTED TO MAIN SOURCE BY MORE THAN ONE LINE)
☐ Y ☐ N PRIORITY RETURN-TO-SERVICE AGREEMENTS FOR PURCHASED POWER

COMMENTS:

PERSONNEL

☐ Y ☐ N CERTIFIED OPERATOR REQUIRED
☐ Y ☐ N CERTIFIED OPERATORS AVAILABLE; NUMBER:
☐ Y ☐ N ADEQUATE PERSONNEL TRAINED FOR REPAIR;
☐ Y ☐ N TRAINING DOCUMENTED

☐ Y ☐ N RESPONSE PERSONNEL LIVE ON BASE;

☐ Y ☐ N HAZARDS AFFECTING ON OR OFF-BASE RESPONSE:
☐ Y ☐ N PERSONNEL SAFETY TRAINING:

COMMENTS:

☐ Y ☐ N RECALL ROSTER

COMMUNICATION EQUIPMENT: ☐ PHONE, ☐ RADIO, ☐ CELL-PHONE, ☐ PAGER; ☐ OTHER:

☐ Y ☐ N ADEQUATE TRANSPORTATION TO REACH WATER SYSTEM COMPONENTS DURING EMERGENCIES AND HAZARDS:

☐ Y ☐ N SECURITY FORCES TRAINED ON LOCATION AND IMPORTANCE OF WATER SYSTEM EQUIPMENT?

COMMENTS:

CONTINGENCY / READINESS PLANS

☐ Y ☐ N WATER SECTION IN CIVIL ENGINEERING CHAPTER OF BASE SUPPORT OR OPLAN
☐ Y ☐ N WATER CONSERVATION PLAN FOR CONTINGENCIES
☐ Y ☐ N ENERGY REDUCTION PLAN FOR CONTINGENCIES
☐ Y ☐ N GENERATOR PLAN FOR CONTINGENCIES
☐ Y ☐ N IDENTIFIES WATER SYSTEM AS HIGH PRIORITY?
☐ Y ☐ N EXERCISES OR TRAINING FOR WATER CONTINGENCIES
☐ Y ☐ N WATER DEMAND ESTIMATES FOR CONTINGENCIES

COMMENTS:

APPENDIX B

WATER VULNERABILITY ASSESSMENT AT ______ AIR FORCE BASE

INTRODUCTION

Water Vulnerability Assessments are a means of identifying potential threats (natural disasters and/or accidents) to the base's ability to provide adequate quantities of potable water. In addition to planning for natural disasters and accidents, a vulnerability assessment for a military installation must include an assessment of the impact of terrorism and sabotage. The report should assess the impact of conventional, chemical, biological, or nuclear attack when they are considered a threat. Intentional contamination of a base's water supply with a deadly agent could produce mass casualties before the facility realizes it has been the target of a terrorist attack. A thorough Water Vulnerability Assessment can help an installation minimize mission impacts by identifying weaknesses in water treatment, storage, and distribution systems and by allowing the base to plan for system disruptions that cannot be prevented.

Air Force Instruction (AFI) 41-106, paragraph 1.5.16, requires that Medical Treatment Facility or Medical Unit Commanders perform water vulnerability assessments. More specifically, Air Force Instruction 48-119, paragraph 9.6.3.4, requires that the base Bioenvironmental Engineering Flight (BEF) conduct sanitary surveys and vulnerability assessments of potable water supplies as well as conduct engineering reviews of proposed modifications to the water system to assess and avert health hazards. The BEF is further responsible for advising the commander with respect to wellhead protection programs, opportunities to enhance water treatment and distribution systems, and alternative management practices to meet compliance requirements and enhance water quality. The BEF conducts these activities in coordination or conjunction with other hospital or base organizations including Civil Engineering and Environmental Management.

METHODOLOGY

The American Water Works Association's Manual 19 outlines a six-step process for conducting emergency planning. This process has been adopted in AFOSH Standard 48-6 (draft) and is briefly summarized as follows.

Step 1: Identify and describe the water system by subsystem/component

The first step is to identify the major components that make up the supply, treatment and distribution subsystems. These components are further characterized in terms of their attributes or external factors that determine whether or not the component will operate properly.

Step 2: Identify probable hazards and hazard magnitude

The second step involves identifying and characterizing both peacetime and war-related hazards that may affect the installation. Both the probability of a hazard event and its likely magnitude should be considered. The resulting set of "design" events will be used to determine impacts on water system components identified in Step 1.

Step 3: Estimate the likely effect on system components

In this step, the impact of each design event is considered relative to the attributes and external factors controlling the proper operation of water system components. This is comparable to a failure modes and effects analysis where the potential for component failure is assessed relative to event magnitude and the probable consequences of this failure on water quality and availability are determined.

In assessing probable effects, consideration must be given to compliance with the Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs). Hazard events can result in changes to source water quality and the introduction of contaminants into the distribution system (e.g., through pipeline breaks or unit malfunction) could cause the facility to exceed the MCLs.

Step 4: Estimate the water demand (quantity/quality) following the event

In estimating water demand, consider both water quantity and quality. Water demand is the sum of the requirements for personal use, firefighting, water system delivery loss, and critical industrial and operational requirements. Additional "demand" is created by broken mains and transmission lines.

Step 5: Estimate the supply shortfall by comparing supply and demand

Overall system vulnerability to a hazard event may be measured in terms of the difference between the available water supply both during and after an event relative to the demand during these same periods. A hazard event may affect water quantity and/or quality. Vulnerability should be measured in terms of the magnitude and duration of any supply shortfall or quality reduction.

Step 6: Identify components responsible for the shortfall or quality reduction and possible mitigating measures

In this final step, component failures are assessed and ranked relative to their contribution to supply shortfall or quality reduction for each event. Those components that contribute the most to a shortfall should be designated as "critical." Mitigating measures are then identified for each component failure or quality degradation with particular attention given to critical component failures.

Note that this process requires cooperative input and joint analysis by the BEF, Civil Engineering, and other affected organizations. It considers both water supply and demand analyses and issues of water quality as well as available/deliverable quantity. With respect to water quality, the Air Force must comply with regulations promulgated under the SDWA, as well as additional regulations developed by the States, and make emergency plans for use of lower quality water. Overseas bases must also consider host nation rules.

LOCATION

Provide a brief description of the installation.

Existing Facilities

General

Provide a general overview of the base water system.

Source

Describe the source of water for the installation.

Treatment

Describe the water treatment process employed to treat the water.

Distribution System

Describe the distribution system in as much detail as is available.

Storage

Describe available water storage. Include both potable and emergency water storage.

Fire fighting

Provide estimates of fire fighting demands. This information should be available through the base fire department.

Personnel

Identify all personnel and offices involved in operating and maintaining the water system.

Supplemental System Components

Describe any supplemental system components to include transportation, communication, contingency connections, power sources, and emergency power supplies.

TABLE 1. INVENTORY OF WATER SYSTEM ASSETS

Key	Description	Location	Use
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

(In Table 1, list and describe all water systems assets. Items to include in this list include treatment facilities, wells, pumps, storage tanks, swimming pools (if they are designated as emergency water sources), valves, hydrants, distribution lines, etc.

RESULTS AND DISCUSSION: SCENARIOS

General

This section presents an analysis of the ________ AFB drinking water system and its ability to provide an uninterrupted supply of potable water under different emergency and disaster scenarios. The degree to which different system components are affected by the proposed scenarios determines the system's vulnerability. Minor emergencies such as main breaks or valve failures can be handled on a case-by-case basis through procedures already established and proven at _______ AFB. More severe emergencies require detailed planning and pooling of resources to properly address the particular situation.

There are numerous possible scenarios that could affect _______ AFB's ability to provide an adequate quantity of high quality potable water at reasonable pressure. Scenarios evaluated for this vulnerability assessment include:

(USE ANY OF THE FOLLOWING THAT APPLY)

- hurricanes, tropical storms, tidal surges
- tornadoes
- lightning strikes
- flash flooding
- aircraft crashes
- sabotage
- unauthorized service connections
- severe drought
- conventional, biological or chemical attack
- nuclear attack

Any of these scenarios could interfere with _______ AFB's ability to supply the required quantity of high quality potable water.

The six step approach detailed in the Methodology Section outlines the procedures for analyzing the vulnerability of a water system. Step 1 (Identify and describe the water system by component) was accomplished in the Location Section for all scenarios. The basic system components are the same regardless of the design event being considered. The following sections detail the application of steps 2 through 6 to each of the proposed scenarios.

Event X **

Step 2: Identify probable hazards and hazard magnitude. Describe probable hazards for the base and the likely magnitude of these events.

Step 3: Estimate the likely effect on system components. Describe how different components of the system will be impacted.

Step 4: Estimate the water demand (quantity and quality) following the event. Describe how the event will impact the demand for water on the base. For example, any event that will result in fires will increase demand.

Step 5: Estimate the supply shortfall by comparing supply and demand. Describe how much water will be available after the event. Any event that damages the system components will impact the quantity of water that can be supplied.

Step 6: Identify components responsible for the shortfall or quality reduction and possible mitigating measures. Identify components that create system vulnerabilities during the given event and detail actions required to make these components less vulnerable.

TABLE 2. EFFECT OF EVENT X ON THE ______ AFB WATER SYSTEM

System Component	Effect of Event on System Component			Type and Extent of Damage	Corrective Measures
	None	Partial	Total		
Water Source					
Distribution System					
Storage					
Personnel					
Power					
Emergency Power					
Transportation					
Communication					

**** This section and Table should be repeated for each event being considered.**

CONCLUSIONS AND RECOMMENDATIONS

This Water Vulnerability Assessment has addressed the ability of the _______ AFB water system to supply the required quantity and quality of water during different emergency scenarios. Common sense and good engineering judgment are critical to a vulnerability assessment, in which the design events are based on 'best guesses' of what actual conditions might occur. This report is not full of detailed numbers or specifics, but rather provides base personnel with a general understanding of the most vulnerable components in their system and gives them a place to start if any of the scenarios actually occurs. Based on the information presented in this report the following specific recommendations and conclusions are made for _______.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

This assessment outlines the general conditions that might exist after an attack or natural disaster. The specific circumstances may vary considerably from the scenarios outlined in this report, but the effect on the system components will be much the same. The most critical factor in responding to and recovering from any emergency or disaster is the common sense, sound judgment, and professional expertise of base personnel charged with making decisions.

REFERENCES

1. LIST ANY REFERENCES USED IN COMPLETING THE REPORT.